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UNITED STATES DEPARTMENT OF AGRICULTURE

BEE-KEEPING *in the* Tulip-Tree Region

E & A
JUN 1922
ENTOM.

MANY THOUSAND colonies of bees occur in the region where the tulip-tree is abundant but the honey crop from tulip-tree flowers is inconsiderable. Too few beekeepers in this region have modern equipment, it is true, but the greatest loss comes from the fact that they do not care for their bees so as to have them ready to gather the abundant nectar from this early-blooming tree.

In this bulletin a method is given for the management of the apiary so that the full honey crop from this source may be obtained.

Contribution from the Bureau of Entomology
L. O. HOWARD, Chief

Washington, D. C. January, 1922

BEEKEEPING IN THE TULIP-TREE REGION.

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The tulip-tree is one of the most dependable early sources of nectar throughout a wide region. It is not, however, the source of much honey at present, for most beekeepers of the section in which this tree is found fail so to manage their bees that they are ready and able to get its vast store of nectar. A lack, in American beekeeping literature, of descriptions of the methods especially applicable to this region is perhaps the chief cause of this loss. The object of this bulletin, therefore, is to outline the practices which will enable the beekeepers of the region to take full advantage of this source. It has been thought best to describe a single successful system, rather than several methods for each phase of the work.

The tulip-tree[1] is also known locally as tulip-poplar, yellow-poplar, blue-poplar, white-poplar, whitewood, cucumber-tree, saddle-tree, saddle-leaf, hickory-poplar, and erroneously as linn-tree, basswood, and lime-tree. It is, of course, quite unlike the basswood.[2] The name "yellow-poplar" is used almost exclusively in the lumber trade. The tulip-tree belongs to the same plant family as the magnolias and is the most northern representative of that family.

GEOGRAPHICAL BOUNDARIES OF THE TULIP-TREE REGION.

The tulip-tree is occasionally found as far north as Vermont and Rhode Island, and west to Michigan, Arkansas, and Louisiana, as indicated in figure 1. On the outer limits of its distribution it is not

[1] *Liriodendron tulipifera*, family Magnoliaceae. [2] *Tilia americana.*

abundant. It is more abundant on the south shore of Lake Erie. It is rare west of the Mississippi River, except in northeastern Arkansas and southeastern Missouri. It is most abundant and the

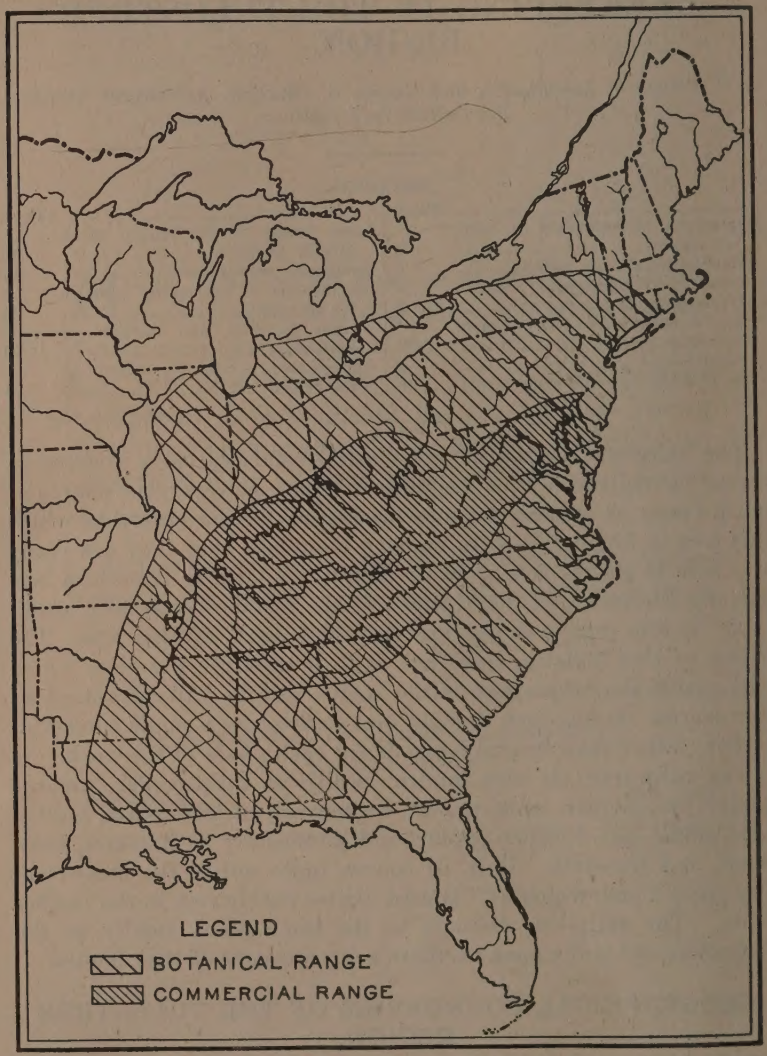


FIG. 1.—Map showing distribution of tulip-trees in the United States. In the heavily shaded area these trees are usually sufficiently abundant to furnish surplus honey. (From data furnished by the Forest Service, United States Department of Agriculture.)

trees are larger in the south-central portion of its range, especially in Tennessee, Kentucky, the western portion of the Carolinas, and in the Ohio River basin. It is common throughout the Piedmont

Plateau in Maryland and Virginia. In the outer limits of its distribution it is found as single trees or in small groups; and it is rarely the dominant forest tree except in the South and under favorable conditions. The tulip-tree beekeeping region may be considered as restricted to those places where it is a common tree, the area being roughly indicated in the closely shade area in figure 1. The tree is, of course, not equally abundant throughout this area.

VARIATIONS WITHIN THE REGION.

The variation in the number of trees of this species within the geographical range has already been mentioned. The trees vary also in size, being larger and more thrifty in those parts of the region where it is more abundant numerically. Beekeepers in regions where the tree is not common rarely list it among the honey-plants, and it is quite possible that in these places the individual flowers do not secrete nectar quite so profusely. No accurate information is available as to any differences in the amount and character of the nectar due to differences in soil. So far as known, the nectar is always dark in color and the resulting honey is somewhat strong in flavor, the variation observed in the nectar of other honey-plants not being observed in this case.

RELATION TO OTHER BEEKEEPING REGIONS.

The northern limits of the tulip-tree are in the clover region, but the tree is most abundant in those parts of the country where white and alsike clovers are not reliable sources of honey. The tulip-tree extends southward into the sourwood[3] region of the southern Appalachian Mountains and is common in some parts of the Coastal Plains of the South, where the tupelo and black gums,[4] gall-berry,[5] and titi[6] are the chief sources. As a rule the tulip-tree region is not coincident with any region where a leguminous plant is the chief source of honey, and in the other regions mentioned tulip-trees are not sufficiently abundant to be considered a main honey source. Since the tulip-tree is found throughout the entire range of sourwood, the modifications of beekeeping practice to obtain sourwood honey will be mentioned later. As the tulip-tree is such an important source of early nectar, the region is one in which the beekeeper will wish to choose methods that will enable him to get all the honey possible from this source.

CHARACTERISTICS OF THE TULIP-TREE.

The tulip-tree is a magnificent forest tree, growing at times to a height of 125 feet and a diameter of 5 to 6 feet. The leaves are large

[3] *Oxydendrum arboreum.* [4] *Nyssa* spp. [5] *Ilex glabra.* [6] *Cyrilla racemiflora.*

and broad, truncate or broadly notched at the apex, with two apical and from two to four basal lobes. The flowers (see title page) are large and erect, with greenish-yellow petals, and are orange-colored within, their resemblance to the flowers of the cultivated tulip giving the tree its common name. Few flowers are more beautiful, but usually they are so high on the branches of tall forest trees that not many persons are familiar with them. The flowers open about three weeks after the average date of the last killing frost in the spring and the blooming period seldom exceeds two weeks. As the flowers wither the petals are gradually reflexed and the flower somewhat loses its resemblance to the tulip. The fruit is a cone about 3 inches long, somewhat resembling a cucumber, hence the common name "cucumber-tree." The trees are badly injured by fires, even when mature.

The tulip-tree has been extensively lumbered wherever it is abundant, and this has doubtless worked a hardship to beekeeping in these regions, but young trees are constantly coming on where conditions are favorable and the region is not permanently injured for beekeeping. Trees begin blossoming when about 15 years old.

The tulip-tree is exacting in its soil and moisture requirements, although it is found under a variety of conditions. The best conditions for growth are a deep, fertile soil, well drained but with constant soil moisture. The tree thrives on moist loam and on rich sandy soils with abundant humus. It does poorly on heavy clay, on dry ridges, or in standing water. It is rare in river swamps, on the serpentine barrens, in lowland forests, in meadows with compact soil, and on hill and mountain tops. On Parrs Ridge, near Westminster, Md., it is scarce, although on near-by hills it constitutes 20 per cent of the forest stand, the rock on Parrs Ridge being igneous with some limestone. The tree is at its best on slopes and in protected coves along water courses and usually on the north and east exposures. It rarely grows in solid stands, but is usually in association with chestnut, oaks, walnuts, hickory, maples, and beech, and sometimes, but infrequently, with pines. In Maryland, the area with which the writers are most familiar, it is found from almost sea level to the mountain slopes of the western part of the State, but it is not found in the mountains in the western part of the State in locations similar to those farther east where it is abundant. Climatic conditions are probably important in its distribution, for it seems to thrive only in those locations where the average length of the annual growing season is over 150 days. Its distribution has been greatly modified by agricultural operations in the regions where agriculture is prosperous, for in some Maryland counties little more than 10 per cent of the land is in forest.

The tulip-tree is one of the finest trees native to America. The foliage is handsome, and it is a clean tree. It is relatively free from insect attacks, although in some localities it is the host of abundant plant-lice which secrete honeydew. This is unfortunate from the standpoint of the beekeeper, and it discolors the leaves somewhat, detracting from their beauty. The reader is referred to Forest Service Circular 93 for information concerning this tree, it being called yellow poplar by the Forest Service.

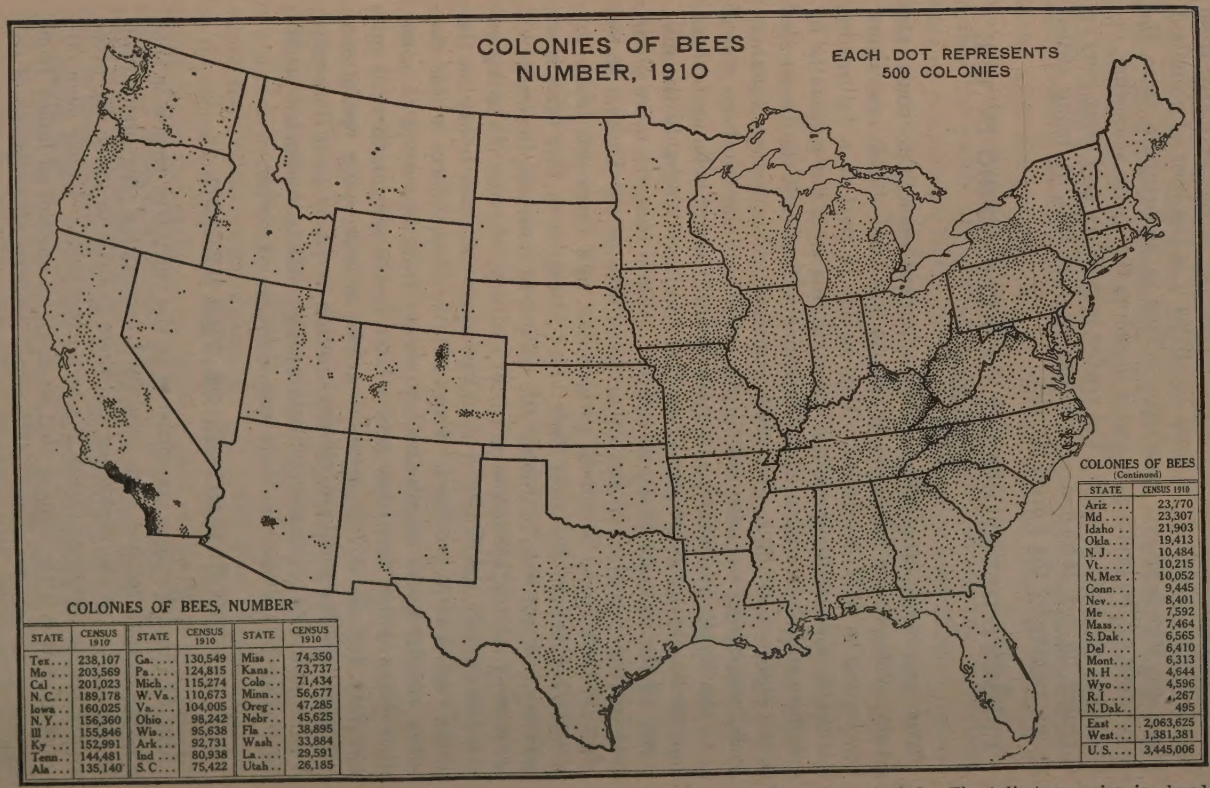
PRESENT DEVELOPMENT OF BEEKEEPING IN THE REGION.

The area where the tulip-tree is abundant enough to constitute an important source of honey is not, as has been stated, one where beekeeping is well developed. This is due in part to a failure by the beekeepers to recognize the value of this tree, but especially to a failure to practice those methods which will permit the bees to be in the right condition to get a full crop from this species. Furthermore, beekeeping has not developed so rapidly in the Southern States as in the North and West, and there are still many colonies of bees kept in box-hives and "gums" in this territory, probably the majority of the colonies being so housed. While bees are more abundant in this area than in any other large area of the United States (fig. 2), beekeeping is not so progressive, and there are few commercial beekeepers devoting their chief attention to this branch of industry. According to Jones,[7] the tulip-tree now supplies only 2.8 per cent of the total honey-crop of the country, whereas if the region were adequately developed it could produce as much honey as the clover region now produces. Especially in those places where the honey resources are augmented by nectar from sourwood or some other plant which furnishes nectar later in the season, there is opportunity for the development of extensive beekeeping operations, and wherever the tulip-tree secretes nectar as freely as it does near Washington, D. C., commercial beekeeping could be conducted profitably, even if this were the only major source of nectar.

PECULIARITIES OF THE REGION.

One of the difficulties encountered in the tulip-tree region is that practically nothing has been published concerning this plant from the standpoint of the beekeeper and there is little to guide the prospective honey-producer except his own experience. Under such circumstances it is little wonder that so small an amount of honey from this source is now produced. The usual beekeeping practices of the

[7] Department Bulletin 685.



COLONIES OF BEES, NUMBER

STATE	CENSUS 1910	STATE	CENSUS 1910	STATE	CENSUS 1910
Tex	238,107	Ga	130,549	Miss	74,350
Mo	203,569	Pa	124,815	Kans	73,737
Cal	201,023	Mich	115,274	Colo	71,434
N. C	189,178	W. Va	110,673	Minn	56,677
Iowa	160,025	Va	104,005	Oreg	47,285
N. Y	156,360	Ohio	98,242	Nebr	45,625
Ill	155,846	Wis	95,638	Fla	38,895
Ky	152,991	Ark	92,731	Wash	33,864
Tenn	144,481	Ind	80,938	La	29,591
Ala	135,140	S. C	75,422	Utah	26,185

COLONIES OF BEES
(Continued)

STATE	CENSUS 1910
Ariz	23,770
Md	23,307
Idaho	21,903
Okla	19,413
N. J	10,484
Vt	10,215
N. Mex	10,052
Conn	9,445
Nev	8,401
Me	7,592
Mass	7,464
S. Dak	6,565
Del	6,410
Mont	6,313
N. H	4,644
Wyo	4,596
R. I	1,267
N. Dak	495
East	2,063,625
West	1,381,381
U. S.	3,445,006

FIG. 2.—Map showing distribution of colonies of bees according to data furnished by the census of 1910. The tulip-tree region is abundantly supplied with bees.

clover region will not serve to bring full results where the tulip-tree is the chief source of honey, although the later and better methods applicable to the clover region are suitable for maximum honey-crops from the tulip-tree, or, in fact, from almost any early honey-source whatever. Beekeeping methods applicable to the wild raspberry region of the North perhaps most nearly approach those needed for the tulip-tree region. The lack of literature concerning the tulip-tree as a honey-plant is a serious one and the chief object of this bulletin is to make up this deficiency.

As the tree blooms so early in the spring, there is little time for the bees to get in proper condition for the gathering of the tulip-tree honey-crop. In this region brood-rearing normally begins between February 15 and March 1, although in unprotected and poorly protected colonies it may begin as early as January. The reason for the earlier beginning of brood-rearing in poorly protected colonies is fully explained in the bulletins of the Department of Agriculture devoted to the wintering of bees. Those colonies which begin brood-rearing too soon are usually so weakened by this unseasonable work that they are not able to get to full strength by the time the tulip-tree blooms, and it is therefore advantageous to retard brood-rearing by protection until the normal time. After it is once started it is to the advantage of the bees and of the beekeeper that it progress as rapidly as possible. A failure to have colonies strong at the beginning of the tulip-tree bloom is the cause of the loss of tons of honey from this source annually.

It will be seen that the proper protection of the bees during the winter becomes a serious problem in this section; in fact, it is more important here than in many parts of the country much farther north. Adequate stores must be provided in the spring, and this is frequently not done. It is also evident that after brood-rearing begins it must progress rapidly, and only a good, prolific young queen can lay the eggs necessary for such a rapid development of the colony strength. Since beekeeping has not been so advanced in this region, it is not surprising to find that most of the bees are inferior blacks or hybrids with but a small amount of Italian blood. These scrub queens may begin egg-laying at the right time and at a good rate, but they often fail and are unable to keep up the pace of egg-laying demanded to get the tulip-tree honey-crop. More detailed methods for remedying these defects will be discussed later.

From what has been said it is evident that the production of a full crop of honey from the tulip-tree demands a high degree of skill on the part of the beekeeper. The chief reasons for failure in this region are poor wintering, inferior queens, and generally poor beekeeping, with box-hives.

TYPE OF HONEY TO BE PRODUCED.

It has been pointed out that the honey from the tulip-tree is dark amber in color and of strong flavor. Such a honey should not be put on the market in the form of comb-honey; extracted honey alone should be produced from this source. Some beekeepers now produce bulk comb-honey ("chunk honey") in this region, but as beekeeping advances there will be a tendency for this type of product to disappear. The honey-flow from the tulip-tree is short, and, as it comes so early in the season, comb-honey production with profit would tax the beekeeper's skill. Unfortunately most beekeepers when taking up modern beekeeping with movable-frame hives get equipment suitable for comb-honey production. Profitable comb-honey production requires more skill than does the production of extracted honey, and it may therefore better be left to the skilled beekeepers. Dark honeys should be extracted, as the general honey markets demand light-colored comb-honeys. There is no demand for bulk comb-honey in the larger honey markets.

OTHER PLANTS IN THE REGION WHICH FURNISH NECTAR.

Throughout the range of the tulip-tree other plants add to the beekeeper's profits. The black locust [8] is found in open fields throughout the area, blooming at the same time or a little later than the tulip-tree. Sourwood,[9] which does not bloom until July, is abundant in the foothills of the Southern States. In a few localities the clovers contribute somewhat to the honey resources, blooming soon after the tulip-tree has ceased. Asters [10] and goldenrods [11] are usually abundant in the fall, in some localities furnishing surplus honey. The linden or basswood [12] is occasionally encountered in the mountains, blooming after the tulip-tree has ceased. Viper's bugloss or blueweed [13] is valuable in the Shenandoah Valley and in the surrounding hills, blooming in August. Buckwheat [14] is grown to some extent in the mountain regions of West Virginia and North Carolina and offers a supply of nectar for the bees long after the tulip-tree has ceased; it usually blooms in August. Fruit bloom, red-bud,[15] persimmon,[16] sweet clover [17] in limited areas, willowherb,[18] holly,[19] sumac,[20] smartweed [21] and Spanish needle [22] are also sources of honey in the chief range of the tulip-tree. In some parts of the tulip-tree region cotton contributes some nectar.

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[8] *Robinia pseudacacia.*
[9] *Oxydendrum arboreum.*
[10] *Aster* spp.
[11] *Solidago* spp.
[12] *Tilia* spp.
[13] *Echium vulgare.*
[14] *Fagopyrum esculentum.*
[15] *Cercis canadensis.*
[16] *Diospros virginiana.*
[17] *Melilotus officinalis.*
[18] *Chamaenerion angustifolium.*
[19] *Ilex opaca.*
[20] *Rhus* spp.
[21] *Polygonum* spp.
[22] *Bidens* spp.

Little modification in beekeeping practices is necessary where the beekeeper has one or more of these plants as important honey sources in addition to the tulip-tree. Some beekeepers in the mountains utilize honey from the tulip-tree for brood-rearing, because the honey is dark and brings a lower price than does that from sourwood. Since to get a crop from the tulip-tree requires that the colonies be strong unusually early, the chief difficulty is in keeping the bees from swarming during the tulip-tree bloom and in keeping up the colony strength until July by continued brood-rearing. Swarm-control methods are given farther on. The continuation of egg-laying may best be insured by frequent requeening from prolific stock. If it is desired to use the tulip-tree honey for brood-rearing, it should be taken from the hives before any lighter honey is gathered and should especially not be in the hives during the blooming period of the sourwood, for if the light honey is mixed with the dark the market value is reduced. The black locust is a valuable source of white honey when the weather is good during the blooming period of a few days, but its secreting period so nearly coincides with that of the tulip-tree that it is rarely possible to get that honey separately.

EQUIPMENT RECOMMENDED.

Many beekeepers in the region where the tulip-tree thrives have their bees in "gums" and box-hives, and it can not be too strongly recommended that these be transferred as rapidly as possible to modern movable-frame hives. For methods of transferring, see Farmers' Bulletin 961. The complaint is often heard in this region that the "patent gums," as movable-frame hives are often called, are too expensive, but it will pay any thoughtful beekeeper to borrow the money to buy the better hives if this is necessary. The advantage of being able to handle the bees far outweighs the cost of equipment. The 10-frame Langstroth hive, now manufactured by all factories making beehives, is the one best suited to the practices here given for beekeeping in this region. This hive is not patented. Care should be exercised to get accurately made hives and frames. The spacing of the frames should be accurate and the parts of all hives should be interchangeable. It should be emphasized that transferring bees to modern hives will not be profitable unless the bees are then properly cared for. If neglected, they will probably not do so well in new hives as they did in the "gums."

The combs of the brood chamber should be all of worker-sized cells. This condition may be obtained best by the use of full sheets of comb-foundation, and no beekeeper of this region can afford to use merely starters of foundation. The frames should be carefully

wired to strengthen the combs. Detailed directions for arranging the sheets of foundation in the frames and for wiring are given in Farmers' Bulletin 447 and in still greater detail in the books on beekeeping. Even when full sheets of worker foundation are used, there will be a tendency for the foundation or the combs to sag, leaving several rows of imperfectly formed cells at the top of the frame. The beekeeper should constantly sort out imperfect combs and use them for the supers. Extra care should be exercised to see that only perfect combs are placed in the lower one of the two hive-bodies during the winter, in order that the queen may pass easily from the second to the first story during the period of brood-rearing previous to the time of unpacking.

As has been stated, most of the bees of this region are of the inferior German or black stock, and this race should be eliminated as rapidly as possible. It has no desirable quality, except that the capping on the combs is whiter as a rule than that made by Italian bees. This is not a matter of moment in the production of either extracted honey or bulk comb-honey. It is common to hear beekeepers of this region state that their bees are Italians, this opinion being based on the common supposition that any bee which shows the least yellow color is Italian. It is, however, rare to find good Italian stock in this region, and it is safe to recommend to all beekeepers that they get new blood in their apiaries unless this has been done within a few years. The German queens of this region are not prolific and are unable to get the colony strength up rapidly, and, as has been shown, this is the most important step in preparation for the gathering of a crop of honey from the tulip-tree. It would pay the better beekeepers of this region to buy young queens every year if there were no other way to get young stock of the Italian race, in order to have colonies of the right strength. This is not necessary, for the beekeeper can rear his own queens as needed, after he becomes familiar with the work. It is, of course, necessary in almost every apiary to buy queens from queen-breeders in order to get better stock. The best plan is to buy several untested queens from each of several breeders, to select as a breeding queen the best one from among these, as indicated by the honey-crop, and then to rear one's own queens. No one queen-breeder can be recommended as better than any others and the best plan is to buy from queen-breeders who have been in the business long enough to have a well-defined strain and have the skill necessary to select and raise good stock. The names and addresses of queen-breeders may be obtained from advertisements in the journals devoted to beekeeping.

ADAPTATIONS OF BEEKEEPING PRACTICE FOR THIS REGION.

To obtain a crop of honey from the tulip-tree it is of the highest importance that the beekeeper begin the work of preparation early. It will not do to wait until the trees are in bloom and then make the most of what the bees are able to do. This results in a reduction of the crop, sometimes to the point where no surplus honey is obtained from the tulip-tree.

OUTLINE OF THE ANNUAL CYCLE IN THIS REGION.

To have a good colony of bees at the beginning of the tulip-tree bloom, it is necessary that the beekeeper begin his preparations about August 15 of the previous year. In most cases there will be honey coming to the hives then or later, and it may still be desirable to extract some honey, but from this time on the beekeeper should have constantly in mind the prosperity of the colony for the coming winter period, giving them during the ensuing six or eight weeks conditions favorable for the rearing of brood for the winter colony. During the winter he should in every way aid the bees in the conservation of their energy, so that they will not begin brood-rearing too early and so that they may also be able to do the work of brood-rearing to the fullest extent in the spring. During the spring before the tulip-tree blooms he should be sure that at all times the bees have abundant stores for brood-rearing or it will be curtailed at this vital time. These helps will bring the colonies to full or approximately full strength at the time the tulip-tree blossoms open, enabling the beekeeper to get the full crop from this source. Having done these important things, his work now lies in preventing the division of the strength of the colonies by swarming before or during the honey-flow and in supplying the bees with abundant room, so that they may ripen and store the honey properly. His plans for increasing his colonies and for requeening will depend on whether there are later honey-flows from which he expects to get a heavy yield, but the essential points of the active season are to prevent division of the strength of the colonies when it would decrease his crop, and to keep the bees contented and working hard whenever there is nectar available.

FALL PREPARATION.

In this region brood-rearing usually ceases for the winter about October 15, and during the period of eight weeks before that time, that is, beginning about August 15, the bees that are to live through the winter to perpetuate the colony must be reared. The bees that constitute the colony on August 15 will practically all have died

before October 15, and any that then remain will be too old to do much of the work of keeping up the colony temperature during the winter season. These old bees will certainly die during the winter, and it will be only those bees which are reared after August 15 that will remain to do the work when normal brood-rearing begins about March 1 of the next year. Brood-rearing naturally decreases in late summer and it is necessary that favorable conditions be provided or the bees may almost cease raising brood, and thus endanger the very life of the colony. The common German bees found in this region are especially likely to stop brood-rearing too soon. As will be explained later in more detail, every colony should have a young queen introduced and laying just before the period of preparation for the winter begins. Room for the rearing of brood must be present. Stores must be present in plenty, and at no time between August 15 and October 15 must there be less than 15 pounds of honey in each hive, for with less honey the bees will almost certainly not rear enough bees for the winter cluster. It will be found advantageous to provide each colony with at least two 10-frame hive-bodies at this time, the brood being reared in the lower hive and the upper one being practically full of honey. This is more than the bees actually need at this season, but, as will be shown later, they will need it during the winter and spring, and if it is provided in late summer, nothing further need be done as to stores. It is a serious mistake, especially in this region, to extract too closely, to reduce the bees to a single hive-body, and to depend on the fall flowers to provide stores for winter, and these are perhaps the most common mistakes of the beekeepers of the region. The requirements of the colonies for the late summer are, therefore, a young queen, two stories for the hive, the upper hive-body full of honey, and enough empty cells in the lower hive-body for the small amount of brood which will then be reared. Nothing else that the beekeeper can then do will contribute to the well-being of the colony.

WINTER CARE.

Throughout this region the winter losses are as high as those experienced by beekeepers much farther north. In the tulip-tree region bees should be wintered out of doors, as cellar wintering is unnecessary and would be fatal with tulip-tree or aster stores. *There is no place in the region where winter packing is not needed*, and it is impossible to get the full crop of honey from the tulip-tree with colonies that have been left without added protection in winter. Detailed directions for the making of one type of winter packing-case are given in Farmers' Bulletin 1012, to which the reader is referred. The quadruple winter-case (fig. 3) therein described is one of the

best for this region. In western Maryland, western Virginia, eastern Kentucky, and all more northern sections where the tulip-tree is a main source of honey the bees should be packed on or before October 15. (See map, fig. 4.) In the more southern sections the packing may be delayed until November 1, but it should not be delayed beyond these dates. Early packing is important in preserving the vitality of the bees which will start the work of the colony the following spring. Throughout the tulip-tree region 4 inches of packing are needed below the bottom of the hive, 6 inches (8 inches in more northern localities) on all sides, and 8 inches or more on top. Dry saw-

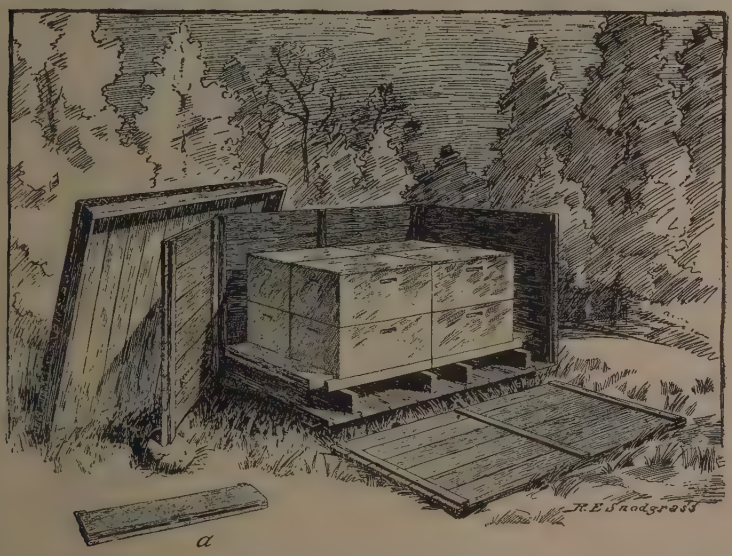

FIG. 3.—The quadruple winter packing case; *a*, Detail of tunnel to hives. Any type of packing case which gives equivalent insulation on bottom, sides, and top may be used.

dust, fine planer shavings, well-dried leaves, or any other finely divided packing material may be used. It is not safe to wait until the leaves fall before packing, for this is often more than a month too late. The entrances to the hives must be reduced as described in the bulletin on wintering above mentioned.

The bees should be wintered in two hive-bodies, just as was described for the late summer (p. 14). It is not safe in this region to put bees into winter quarters outdoors on less than 45 pounds of stores, for while a considerable quantity of nectar may come in during the early spring, occasionally this does not happen in this region, and it is necessary that the beekeeper leave the amount specified in order to insure the proper building up of the colony after March 1.

It is much safer to leave the entire amount all winter than it is to give more before the time of unpacking in May.

SPRING CARE.

If the bees have been wintered as described, and if a young, vigorous queen has been introduced to each colony the preceding August,

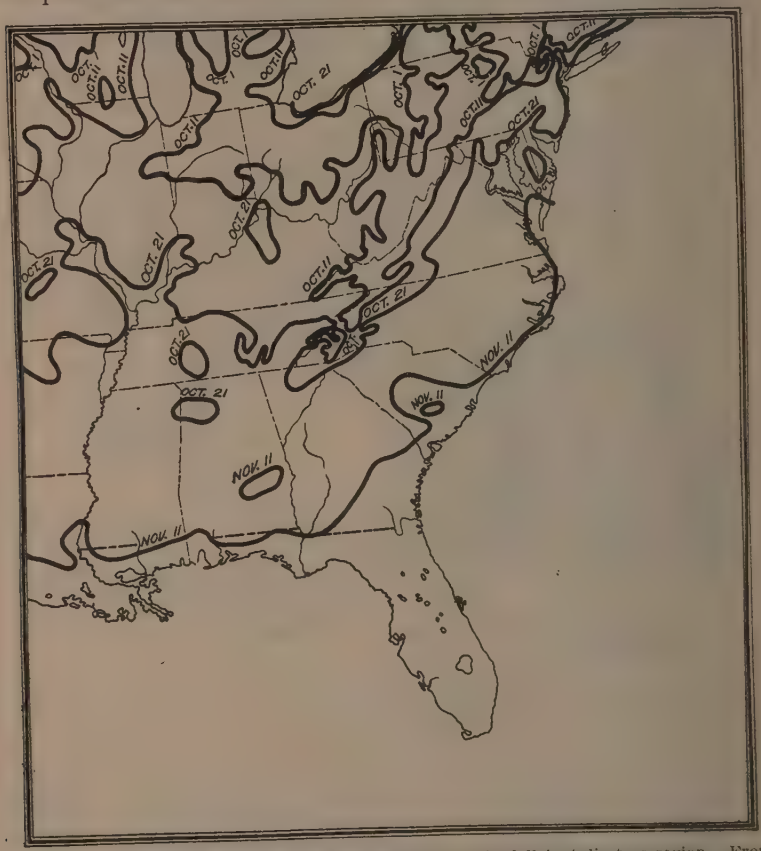

FIG. 4.—Map showing average date of first killing frost in fall in tulip-tree region. From these data the beekeeper determines when to pack bees for winter. Feeding to improve quality of winter stores is done after a killing frost.

there is little that the beekeeper can do that will add to the prosperity of the bees after spring brood-rearing begins and until time to unpack the bees. The entrances to the packing cases should be enlarged soon after brood-rearing begins. There will be plenty of stores, plenty of room for the rearing of all the brood possible, and plenty of protection, for the bees will not be unpacked until just in time to handle them in preparation for the gathering of the

honey-crop from the tulip-tree. If the beekeeper knows that he has not done all of the things that he should in advance, he may then add any of the three necessary factors in the spring, but this is dangerous practice, for too often it is done too late. The practice of clipping the queen's wings during the early spring can not be followed, as often advised, for the queen can not well be found while the bees are in their winter cases.

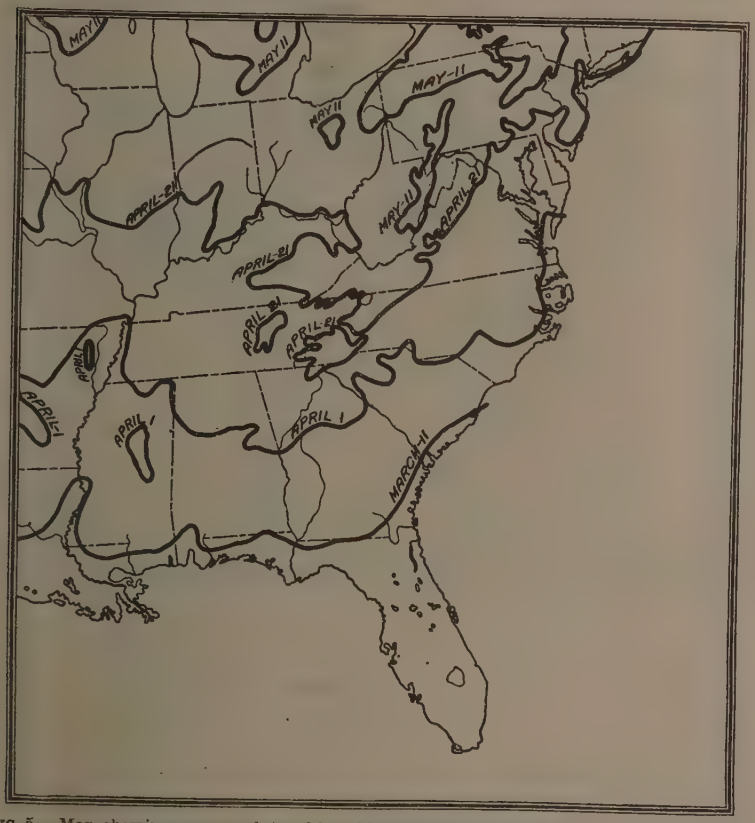

FIG. 5.—Map showing average date of last killing frost in tulip-tree region. From these data the beekeeper determines when to remove the winter protection and estimates the time of the beginning of nectar secretion of the tulip-tree.

The time to unpack the bees will be four or five days before the tulip-tree is in bloom, usually the first week in May, perhaps a little earlier in the more southern limits of this plant. (See map, fig. 5.) It may happen that a few colonies will cast swarms, especially if they have defective brood-combs, before the scheduled time for unpacking, in which event the swarm should be placed in a new hive directly beside the colony from which it came. In the event that a

swarm issues, the packing case containing the parent colony should be removed within a week. On the seventh day the parent colony is set to one side and the swarm is put in its place, with such supers as are necessary for receiving incoming nectar. The hive containing the parent colony is now gently set on top of the hive containing the swarm, thus placing the entire field force with the swarm. Ten days after this operation the parent colony and the swarm are united. If the tulip-tree honey-flow is heavy and if the weather is good, simply set the hive bodies of the parent colony as supers on the swarm. If the honey-flow is light, place one thickness of newspaper between the parent colony and the swarm.

As a rule there will be no swarming until after unpacking, but this will then come on with great rapidity unless the beekeeper takes the precautions later described. With the methods herein described the spring work of the apiary is reduced almost to zero, but the beekeeper should take this time to get everything in readiness for the honey-flow, for it will come on almost immediately after the bees are unpacked.

ADDITIONAL ROOM FOR HONEY.

In the production of extracted honey, which is strongly advised for this region, the placing of extra hive-bodies for the honey is not a complicated process, as in the production of comb-honey. As a rule the honey-flow from the tulip-tree begins suddenly on a bright warm day and the incoming nectar comes with a rush. It is, of course, necessary that plenty of room be provided for this honey, and a common fault in the region is a failure to provide enough room. At least two additional 10-frame hive-bodies will be needed for every colony that is in normal condition, and one of these should be added as soon as the bees are unpacked from the winter cases. If the honey-flow is good the beekeeper should examine the colonies every few days, for it will be necessary to give most of them more room. Because of the amount of water in nectar from the tulip-tree, considerable room is needed for ripening honey as well as for storage, and a failure to provide this often greatly reduces the crop. It is quite possible in this region for good colonies to require a total space of six 10-frame hive-bodies before the close of the honey-flow from the tulip-tree, and there will be colonies that need seven. The measures advised for swarm control influence the arrangement of the supers, as will be described further on.

SWARM CONTROL.

After taking all the precautions to have a full-sized colony, it would be the height of folly for the beekeeper to allow the bees to divide their working force by swarming during the short time when

tulip-tree blossoms are pouring out nectar, and this is just the time when they will swarm normally unless steps are taken to prevent this. Too many beekeepers of the region still look on swarming as indicating a prosperous condition of the bees, failing to realize that this phenomenon, if unchecked, destroys all chance of a further crop from any short early honey-flows. Every precaution should be taken, therefore, to prevent swarming, and if any increase in the number of colonies is desired, this should be made by artificial division after the honey-flow, but before August 15.

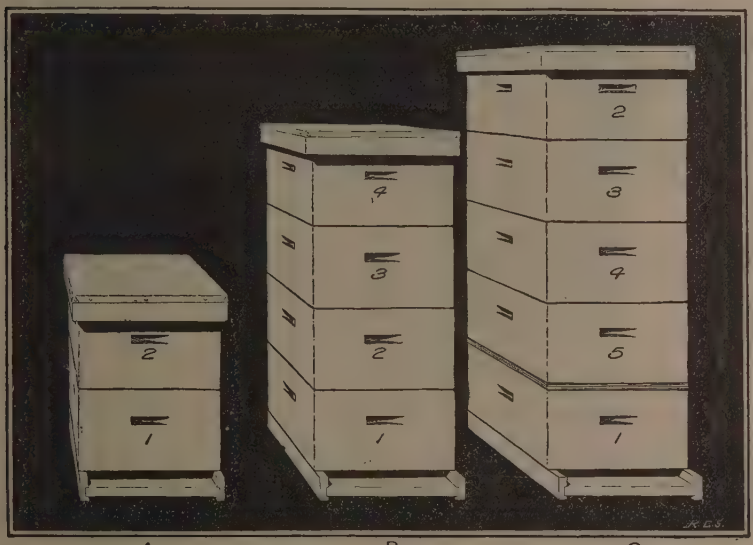

FIG. 6.—Diagram of swarm-control method for extracted honey production. *A*. Brood in both hive-bodies in the spring. *B*. Supers 3 and 4 are added as more room is needed, queen usually abandoning lower brood-chamber. *C*. Queen placed below queen-excluder in (1) after all brood in this hive-body has been sealed. Empty super (5) is added and brood-chamber (2) is placed on top.

Before the bees are unpacked there will be brood in both of the hive-bodies (fig. 6, *A*), unless the queen has been prevented from going from the second story to the first by imperfection of the combs (see p. 12). As soon as they are unpacked and additional hive-bodies are given, the queen will almost invariably desert the lower hive-body and will then lay eggs in combs in the second and third bodies (fig. 6, *B*). In a short time the lowest hive-body will contain only sealed brood, but in the meantime the bees will have filled many cells in this hive-body with pollen and there may be a little honey there. Ten days after the bees are unpacked, if any queencells are started in preparation for swarming, these queencells should be cut out and the queen should be removed from the brood on which she is found and

placed in the first or lowest hive-body (fig. 6, *C*). A queen-excluder should then be placed over this lowest hive-body. On top of this should be placed two supers or hive-bodies for the storage of honey and above these the hive-bodies containing brood. This operation separates the queen and the brood by the space of two hive-bodies and this will act as a preventive to further efforts to swarm, at least during the short time of the honey-flow from the tulip-tree. Ten days later it may be necessary to remove queencells from the brood on top of the hives, although this is not always necessary even if queens are reared so far above the new brood-chamber. The hive-body which was formerly the second story will contain ten frames and not eight as in the supers, and this is the hive-body which should be left with the bees after the removal of the supers.

In producing comb-honey or bulk comb-honey, the control of swarming must be by other means than the one here given. For methods applicable for such cases the reader is referred to Farmers' Bulletin 1039, "Commercial Comb-Honey Production," in which swarm control in comb-honey production is discussed. Methods in producing bulk comb-honey will be the same as for comb-honey. For a general discussion of swarm-control methods, the reader is referred to Farmers' Bulletin 1198.

REMOVAL OF THE HONEY-CROP.

The outfit needed for extracting and the methods to be employed will depend on the size of the apiaries maintained. Special attention should be called to the necessity of having abundant supers to hold the heavy honey-flow from the tulip-tree and to provide room for ripening before extraction. A failure to provide these may result in a loss of half the crop. It is customary to use eight frames with wider spacing in a 10-frame super. If foundation is being drawn in the supers not less than nine should be used. While efficiency in methods of extracting is important in enabling the beekeeper to maintain a large number of colonies, this phase of the work has been so fully discussed in the books devoted to beekeeping that it does not seem best to attempt to include it in the present bulletin. This part of the work in the tulip-tree region will be the same as in other beekeeping regions, and the consideration of first importance is the production of honey to extract.

PREPARATION FOR LATER HONEY-FLOWS.

If following the honey-flow from the tulip-tree there is reason to expect a honey-flow from another species of plant, as from sourwood in part of this region, the beekeeper must leave the bees in condition

after the tulip-tree ceases to bloom so that brood-rearing will be continued almost without interruption. The honey should not all be taken from the bees at this time, but they should be left with at least two hive-bodies, the upper one well filled with honey. Since honey from the tulip-tree is dark and strong, some beekeepers prefer to use it for brood-rearing and to take away all the honey from sourwood or other light honeys. Large quantities of stores will be needed for the proper maintenance of the bees during the interval until sourwood blooms and there could be no greater mistake than to confine the bees to one hive-body with only a small amount of honey.

As a further aid to maintaining the rearing of brood, it might be desirable to requeen all colonies during or just at the end of the honey-flow from the tulip-tree. This should not be done at this time unless there is an interval of at least six weeks before the next honey-flow is expected. The best time for requeening is discussed elsewhere.

DISEASE CONTROL.

Bees are subject to two infectious diseases of the brood which sometimes cause serious loss to the beekeeper. American foulbrood is found in a few localities in the tulip-tree region, and the shaking treatment which is necessary for this disease is described in Farmers' Bulletin 1084, to which the reader is referred. In case this disease is encountered, the best time to treat it will be during the tulip-tree honey-flow.

A few cases of European foulbrood have been found in this region. With the methods of beekeeping practice herein described, however, there will be no danger of loss from this disease, for the things here advocated are exactly the practices which are used for the prevention of the disease. For details the reader is referred to Farmers' Bulletin 975. Young, vigorous Italian queens and conditions favorable for the rapid building up of the colony in early spring are the two factors in preventing this disease, and in this region they are the two factors which bring the honey-crop. The good beekeeper of this region need not, therefore, fear this disease. In case it is discovered, this is conclusive proof that the methods of the apiary are not the best for the region. Steps should then be taken to get the disease under control by remedial measures and from that time on the beekeeper will find it greatly to his advantage to follow the plans for beekeeping herein set forth. In the Shenandoah Valley there is a great deal of European foulbrood. This valley lies within the limits here given for the tulip-tree but this species does not thrive on the valley floor, and this gives a better chance for the disease to develop and spread. The chief source of honey in the valley

is the blueweed or viper's bugloss, which blooms later in the summer. Beekeepers in the valley will find it helpful to practice the methods of wintering herein described and especially important to introduce young Italian queens frequently.

TIME AND FREQUENCY OF REQUEENING.

It will be evident that there must be no interruption of brood-rearing during the period of rearing bees for the winter colony, and it is also obvious that nothing should be done which will stop egg-laying for even a day during the time between March 1 and May 10. During the spring it is difficult to rear queens and in the winter packing-cases it would be practically impossible to find the old queens and introduce new ones. Clearly, then, requeening should be done between May 10 and August 15. The exact time will depend on whether or not there is any honey-flow other than that from the tulip-tree. If there is a honey-flow following this, then the beekeeper will wish to continue brood-rearing without interruption. The best time to introduce new queens, so far as preparation for winter is concerned, is just in time for them to be mated and laying by August 15. If the beekeeper rears his own queens, as he should if he is heavily engaged in beekeeping, then he may start a lot of queencells in late July. About three days before the young queens are due to emerge, the beekeeper should remove the old queen from each colony. Two days later he should give a queencell to each queenless colony. In due time after emergence the young queen will fly from the hive and mate with a drone. After an interval of about two days after mating she will take up the work of egg-laying, and the young queen will be more able to lay a goodly supply of eggs in the late summer than will an old one. Since some queens may be lost in matings it is well to have additional queencells for this emergency. For methods of rearing queens the reader must be referred to the books on beekeeping, but it may be said that the successful beekeeper should make himself familiar with this branch of the work as soon as possible and should not depend on the purchase of all of his queens from queen-breeders.

With the methods of beekeeping herein described, it will be found almost necessary to requeen every August. Many beekeepers practice requeening every second year, but if this is done it will be observed that a considerable number of the two-year-old queens will not be able to lay enough eggs to build up the colony properly during the spring, and obviously this failure will result in a great reduction of the honey-crop. Good queens are the most important single item in the apiary management, and they are worth all the time and expense required to get them. Those beekeepers

who leave the matter of rearing queens entirely to the bees must expect in the tulip-tree region to suffer a loss of at least half the honey-crop.

INCREASE.

It will be evident from what has been said that any increase in the number of colonies by division before or during the honey-flow from tulip-tree will result in a decrease in the honey-crop, except when such increase is made from brood which will emerge too late to take part in gathering the crop (p. 18). It is also detrimental to make increase after August 15, when bees for winter are being reared. Increase is therefore limited in time, just as is requeening.

When a permanent increase in the number of colonies is desired, the large colonies may be divided at the time of requeening, thus utilizing the workers that would not live through winter and that will not be serviceable in gathering a honey-crop. No new colony should be started with less than enough bees to care for four or five frames of emerging brood. The brood should chiefly be placed in those colonies which are moved away from the old stand. Queen-cells should be furnished within two days to all queenless colonies, and under no circumstances should the beekeeper allow these small colonies to rear their own queens, as such queens are almost always inferior.

A simple way to make increase at this time, when each colony is to be divided into two and when the beekeeper has only one apiary, is to remove the lower hive-body containing the queen and brood to a new location. On the old stand is placed a hive containing empty combs, and a queencell is placed between the combs in a cell-protector, the second story being put in place, A hive-body containing full combs of honey is placed on the removed hive containing the queen, for their winter food supply. To prevent the return of too many of the bees of the new colony to their old location, the entrance of the new hive should be closed with green grass. As this dries the bees are released. When outapiaries are maintained the original hive can be divided into two equal parts, the queenless portion given a queencell, and one part moved to another apiary to prevent return to the old stand.

MARKET FACILITIES AND METHODS OF MARKETING.

The tulip-tree grows in a part of the country where the people are accustomed to eat considerable honey, and there is rarely any difficulty in selling the crop near the point of production. Because tulip-tree honey is dark and rather strong in flavor, there is little present demand for it on the larger honey markets of the country,

except sometimes for the baking trade. It should therefore be the plan of the beekeepers of this region to sell their honey locally, at least until a larger market may be developed. The Southern States are now considerable producers of honey, yet honey is sent into these States every year in large quantities from the North and West. With the vast resources from the tulip-tree and other nectar-producing plants this is an unfortunate condition, and it will be found that honey is a vastly superior food to the sirups and molasses so much used.

Bulk comb-honey is perhaps the most common form of honey now on this market, but it will be better for the beekeeper and for his customers if tulip-tree honey is extracted. It may take a little time for the beekeeper to acquaint his customers with honey in this form, and perhaps for a time some beekeepers will find it profitable to produce some bulk comb-honey for their trade, but as rapidly as possible the change to extracted honey should be made. This may be marketed locally in special glass jars, quart fruit jars, tin cans of $2\frac{1}{2}$, 5, and 10 pounds capacity, or in any other form which seems best to appeal to the trade. Each package should be labeled to conform with Federal and State laws. The mistake should not be made of marketing the honey only in small jars, for this does not suggest to customers the possibility of buying honey in the larger quantities. Owing to its dark color tulip-tree honey is preferably marketed in tin cans.

Tulip-tree honey may be used for the manufacture of fine honey vinegar. One and one-half pounds of honey should be diluted with sufficient water to make 1 gallon. To this a small quantity of yeast is added and it is then placed in jugs or barrels during the process of fermentation. A small opening for the admission of air is necessary, but this opening should be plugged with cotton to prevent the entrance of dust, dirt, and insects. The time needed for the entire fermentation will depend on the temperature, but it may be expected to require several months. Such vinegar may be made for home use and with the amount of honey specified it will be found that the vinegar is quite strong. A market should be developed for some of this product, because of its superiority over other vinegars. Tulip-tree honey is especially valuable for this purpose because of its strong flavor and dark color, the milder honeys producing vinegar with little characteristic flavor.

OPPORTUNITIES FOR THE DEVELOPMENT OF THE REGION.

With the tons and tons of nectar going to waste every year in the tulip-tree region because the colonies of bees are not strong enough

to get the full amount of surplus, there is no question that this area may furnish many times more honey than it does at present. That this honey can be marketed at a profit is attested by the fact that this section now sends to outside regions for part of its honey supply. There is not the local prejudice to dark honey which exists in the clover region and in the West. All of these factors taken together make the region one of promise. The enormous number of colonies of bees in this region is proof of the great nectar resources, and if these colonies are given proper care vast quantities of honey can be produced.

If the beekeepers of the region will abandon the "gums" and box-hives for modern equipment, and if they will adopt the practices for their beekeeping which are herein set forth in brief, they will find it possible to engage in beekeeping to a much greater extent than has been customary in the past. The region needs, more than anything else, more men engaged in beekeeping on a commercial scale, men who make it their chief or only occupation. The possibilities of the region are such that this procedure can be recommended and it is evident that it will be impossible for the man with only a few colonies to make the study of the business which will insure success under the peculiarities of this region. Careless beekeeping is entirely unprofitable, especially in a region where the main honey-flow comes so soon after the last killing frost of the spring. Only the beekeeper who studies his work and who takes the proper care of his bees can hope to make beekeeping a success in this region.

In connection with this bulletin the reader should refer especially to the following publications, all of which may be obtained without charge from the Department of Agriculture, Washington, D. C.:

Farmers' Bulletin 447, Bees.
Farmers' Bulletin 653, Honey and Its Uses in the Home.
Farmers' Bulletin 961, Transferring Bees to Modern Hives.
Farmers' Bulletin 975, The Control of European Foulbrood.
Farmers' Bulletin 1012, Preparation of Bees for Outdoor Wintering.
Farmers' Bulletin 1084, The Control of American Foulbrood.
Farmers' Bulletin 1198, Swarm Control.

Semimonthly reports of market conditions and prices prevailing in the principal producing areas and on the leading commercial honey markets of the country may be had free on request from the Bureau of Markets and Crop Estimates, Department of Agriculture, Washington, D. C.

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